SIM Test-Bed 3 Real-time Control Software

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Poster presentation

BIOGRAPHY

Dr. Elizabeth McKenney received a BSE in Electrical Engineering and Computer Science from Princeton University in 1984. She also has an MSE in Mechanical and Aerospace Engineering from Princeton, and in 1995 completed a Ph. D in Mechanical Engineering from the California Institute of Technology. Her career at JPL, since 1996, has been spent developing software and electronics for several of the SIM testbeds. In 2001 she was selected for the JPL Software Architect training program. Currently she is software lead on SIM's System Testbed 3.

ABSTRACT

SIM System Testbed 3 (STB3) features three optical interferometers sharing a common baseline, as a dynamic representation of the SIM interferometer. An artificial star feeding the interferometers is installed on a separate optics bench. All three baselines use avalanche photo diodes (APDs) to measure the position and quality of fringes, and additional pointing precision is achieved by fast steering mirrors (FSMs) that keep the star images centered on the beam combining optics using a CCD camera. Each interferometer uses internal metrology to measure changes in its optical pathlength. Changes in the baseline vector are measured by external metrology beams.

This system acquires and tracks white light fringes with one interferometer, while the other two acquire and track laser light fringes representing the bright guide stars that will be used by SIM. The white light source represents a dim star that cannot supply enough photons for the Science interferometer to lock onto fringes in closed-loop mode; instead it operates open-loop, using pathlength corrections fed to it from the two guide interferometers and the external metrology subsystem to reject disturbances and maintain the fringes. This tracking mode is known as Pathlength FeedForward (PFF).

The precise real-time behavior required to achieve this result is implemented by a complex set of interacting software control loops. This paper describes the design of these loops and how they work together to accomplish STB3's objectives.

KEY WORDS: Interferometry, atmospherics, real-time control, testbed

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